Petrography and Economic Potential of Banded Iron Formation of the Neoproterozoic-Age Buem Formation, Ghana

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Abstract

Historically, Ghana has relied mostly on gold, bauxite, and manganese as the major contributors to the domestic economy. Further investigation into other minerals to transform the mining sector in Ghana focused on detailed geologic field mapping and sampling. The Buem Formation of eastern Ghana, previously unrecognized as a potential source for ore deposits, was found to host banded iron formation. Banded Iron Formations ('BIFs') are chemical precipitates characterized by the presence of alternating layers of iron-rich and amorphous silica-rich layers.

The Buem Group comprises a complex series of metasedimentary, volcaniclastic, and volcanic rock units, including poorly-defined banded iron formation occurrences. This study reports our initial petrographic observations and economic assessment of the Gyamurume–Wawaso Range, one of the host regions for BIF. Petrographic studies show that stratigraphic contacts between dominantly hematitic ferruginous horizons and siliceous strata are distinctly sharp and abrupt. Most hematite comprises micron-scale, irregular grains interstitial to granular, undulatory-extinction quartz; cross-cutting coarse quartz veinlets are barren of iron oxides. Although some BIF strata show former magnetite skeletal textures, even cm-scale ferruginous strata show only trace residual or relic magnetite. Initial studies of the mineralogical composition of Beum Formation BIF show that hematite is abundant, with nominal or no magnetite. No other silicate minerals are observed. Continued studies will assess the trace element contents of Beum Formation iron minerals, with emphasis on the P and Ti contents on hematite-dominant strata as a means of distinguishing low-contaminant, potentially economic horizons.

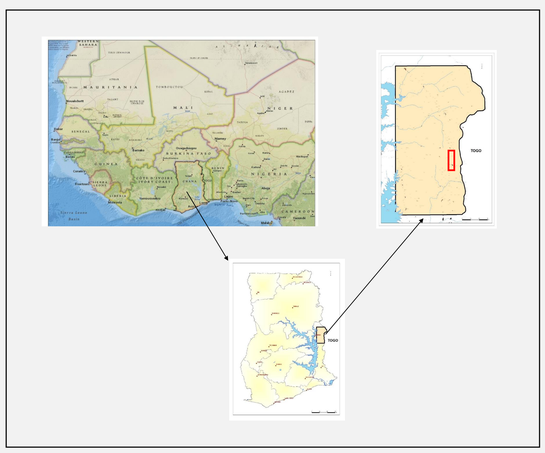

FIGURE 1: *Location of Study Area.*

Main Objectives

- Conduct petrographic studies of the Buem Formation BIF.
- Assess trace elements with emphasis on P and Ti contents.
- Determine the economic potency of the iron minerals in the Buem Formation BIF.

Significance of Study

- Bring diversification in the mineral and mining sector of Ghana.
- Explore the mineral potential of other parts of Ghana.
- BIFs have more than 15% iron content and host the world's largest iron ore deposits.
- Knowledge transfer to boost Ghana's iron and steel industry.
- Ghana's economy could directly benefit from identifying the quality of the iron deposit.

Geologic Setting

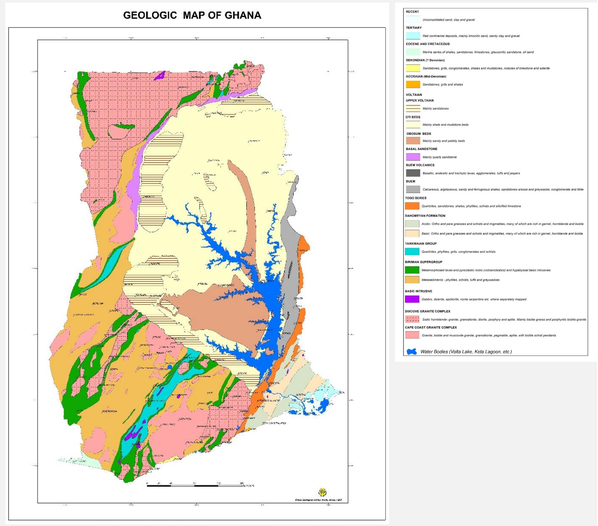

FIGURE 2: *Geologic Map of Ghana (Ghana Geological Survey Authority).*

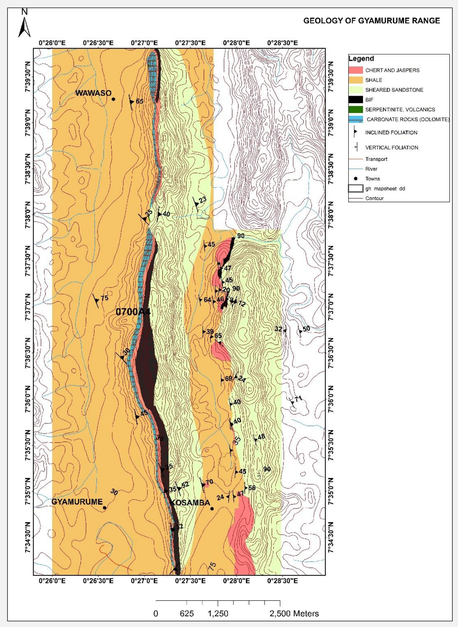

FIGURE 3: *Geologic Map of the study Area (Unpublished, Ghana Geological Survey Authority).*

Methodology

1. Sample collection (outcrops of BIF).
   - 18 samples collected at 14 sample points with BIF exposure.
2. Optical and reflected-light petrology.
   - Characterization of polished thin sections
3. Chemical analysis.
4. Electron microprobe analysis.

Samples Location Map

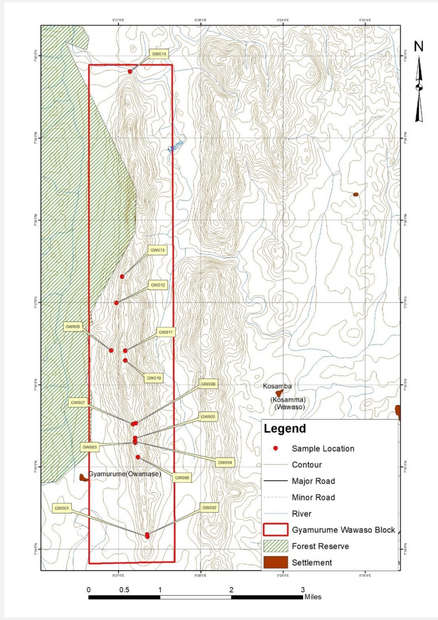

FIGURE 4: *Sample locations in the Gyamurume-Wawaso Range.*

FIGURE 5: *Western view of the Gyamurume-Wawaso Range.*

FIGURE 6: *Outcrop of BIF* ***a)*** *Folded BIF outcrop* ***b)*** *Conglomerate band sandwiched between BIF* ***c)*** *BIF outcrop crosscut by quartz veins and veinlets* ***d)*** *Folded and oxidized BIF outcrop.*

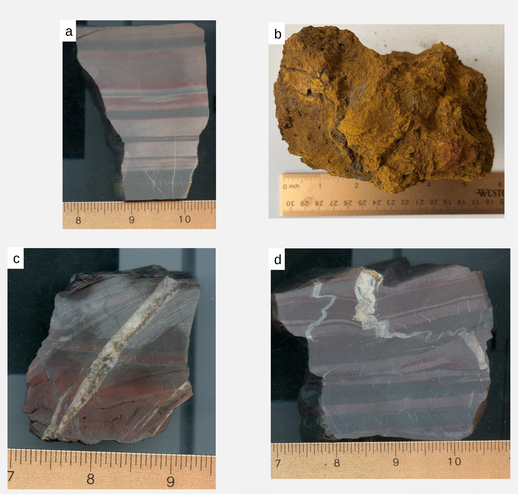

FIGURE 7: *Hand samples of BIF* ***a)*** *well banded BIF* ***b)*** *Highly oxidized BIF sample with goethite* ***c)*** *Quartz vein crosscutting BIF* ***d)*** *Deformed quartz vein crosscutting BIF.*

Petrography

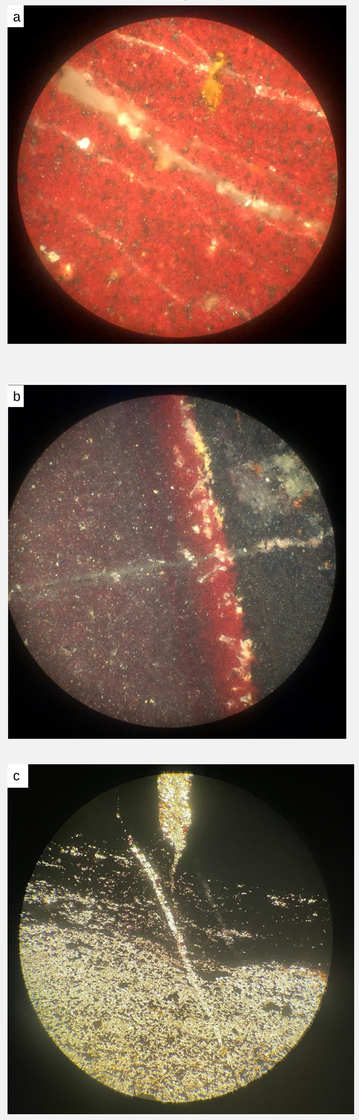

FIGURE 8: *Hand samples of BIF* ***a)*** *hematite with quartz banding* ***b)*** *quartz and fine hematite with barren quartz crosscutting* ***c)*** *Fine grain quartz veinlet crosscutting and displacing hematite.*

Preliminary Conclusions

- BIF in the Gyamurume–Wawaso Range is crosscut by numerous quartz veins and veinlets which are mostly barren of hematite. No other silicates have been observed.
- It is expected that the studies will define the paragenesis of ore and gangue minerals.

Future Work

- Continued petrographic studies on BIF samples.
- Rock geochemistry to ascertain the P and Ti content.
- Electron microprobe analysis of iron oxides for trace element content.

Acknowledgments

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